

CLAIMS

1 1. A system for registering an object in six degrees of freedom using a machine
2 vision system comprising:

3 a search tool of the machine vision system adapted to recognize a plurality of in-
4 stances of a trained pattern, the plurality of instances each being transformed to exhibit
5 different amounts of aspect and shear.

1 2. The system as set forth in claim 1 wherein the search tool is further adapted to
2 provide a plurality of search results corresponding to a plurality of instances of the
3 trained pattern.

1 3. The system as set forth in claim 2 further comprising a combiner that uses the
2 plurality of search results so as to provide a location of the object in the six degrees of
3 freedom.

1 4. The system as set forth in claim 3 wherein the combiner includes means for
2 providing aspect and shear given search results corresponding to different instances of the
3 trained pattern on the object, wherein found relative positions of the instances of the
4 trained pattern is compared with known relative positions of the instances of the trained
5 pattern.

1 5. The system as set forth in claim 4 wherein the means for providing includes a
2 linear transform between the expected relative position of each of the instances of the
3 trained pattern and a normalized measured position of the instances of the trained pattern.

1 6. The system as set forth in claim 1 wherein the plurality of instances of the
2 trained pattern comprise a plurality of transposed, synthetically generated image data, and
3 the different amounts of aspect and shear are based upon predetermined known incre-
4 ments.

1 7. The system as set forth in claim 1 wherein the plurality of instances of the
2 trained pattern comprise a plurality of different user-specified values for aspect and shear
3 provided at runtime to the search tool so as to change an orientation of the trained pattern.

1 8. The system as set forth in claim 1 wherein the plurality of instances of the
2 trained pattern each comprise portions of an overall pattern.

1 9. A method for registering an object in six degrees of freedom using a machine
2 vision system comprising:
3 recognizing, with a search tool of the machine vision system, a plurality of in-
4 stances of a trained pattern, the plurality of instances each being transformed to exhibit
5 different amounts of aspect and shear.

1 10. The method as set forth in claim 9 further comprising providing, with the
2 search tool, a plurality of search results corresponding to a plurality of instances of the
3 trained pattern.

1 11. The method as set forth in claim 10 further comprising combining the plural-
2 ity of search results so as to provide a location of the object in the six degrees of freedom.

1 12. The method as set forth in claim 11 wherein the step of combining includes
2 providing aspect and shear given search results corresponding to different instances of the
3 trained pattern on the object, and including comparing found relative positions of the in-
4 stances of the trained pattern is compared with known relative positions of the instances
5 of the trained pattern.

1 13. The method as set forth in claim 12 wherein the step of providing aspect and
2 shear includes applying a linear transform between the expected relative position of each
3 of the instances of the trained pattern and a normalized measured position of the instances
4 of the trained pattern.

1 13. The method as set forth in claim 11 further comprising scoring each of the
2 plurality of search results and selecting best scoring of the search results for combining
3 by the step of combining.

1 15. The method as set forth in claim 9 wherein the plurality of instances of the
2 trained pattern comprise a plurality of transposed, synthetically generated image data, and
3 the different amounts of aspect and shear are based upon predetermined known incre-
4 ments.

1 16. The method as set forth in claim 9 wherein the plurality of instances of the
2 trained pattern comprise a plurality of different user-specified values for aspect and shear
3 provided at runtime to the search tool so as to change an orientation of the trained pattern.

1 17. The method as set forth in claim 9 wherein the plurality of instances of the
2 trained pattern each comprise portions of an overall pattern.

1 18. A computer-readable medium including program instructions executed on a
2 computer for registering an object in six degrees of freedom using a machine vision sys-
3 tem, the computer-readable medium including program instructions for performing the
4 steps of:

5 recognizing, with a search tool of the machine vision system, a plurality of in-
6 stances of a trained pattern, the plurality of instances each being transformed to exhibit
7 different amounts of aspect and shear.

1 19. The computer-readable medium as set forth in claim 18 further comprising
2 providing, with the search tool, a plurality of search results corresponding to a plurality of
3 instances of the trained pattern.

1 20. The computer-readable medium as set forth in claim 19 further comprising
2 combining the plurality of search results so as to provide a location of the object in the
3 six degrees of freedom.

1 21. The computer-readable medium as set forth in claim 20 wherein the step of
2 combining includes providing aspect and shear given search results corresponding to dif-
3 ferent instances of the trained pattern on the object, and including comparing found rela-
4 tive positions of the instances of the trained pattern is compared with known relative po-
5 sitions of the instances of the trained pattern.

1 22. The computer-readable medium as set forth in claim 21 wherein the step of
2 providing aspect and shear includes applying a linear transform between the expected
3 relative position of each of the instances of the trained pattern and a normalized measured
4 position of the instances of the trained pattern.

1 23. The computer-readable medium as set forth in claim 20 further comprising
2 scoring each of the plurality of search results and selecting best scoring of the search re-
3 sults for combining by the step of combining.

1 24. The computer-readable medium as set forth in claim 18 wherein the plurality
2 of instances of the trained pattern comprise a plurality of transposed, synthetically gener-
3 ated image data, and the different amounts of aspect and shear are based upon predeter-
4 mined known increments.

1 25. The computer-readable medium as set forth in claim 18 wherein the plurality
2 of instances of the trained pattern comprise a plurality of different user-specified values
3 for aspect and shear provided at runtime to the search tool so as to change an orientation
4 of the trained pattern.

1 26. The computer-readable medium as set forth in claim 18 wherein the plurality
2 of instances of the trained pattern each comprise portions of an overall pattern.